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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No. 113/61561US	*Total Pages*
First Named Inventor or Application Identifier Hiroshi KOWAKI	
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APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: Assistant Commissioner for Patents
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Washington, D.C. 20231

1. [x] Fee Transmittal Form
(Submit an original, and a duplicate for fee processing)

2. [x] Specification [Total Pages 25]
(preferred arrangement set forth below)
- Descriptive title of the Invention
- Cross References to Related Applications
- Statement Regarding Fed sponsored R & D
- Reference to Microfiche Appendix
- Background of the Invention
- Brief Summary of the Invention
- Brief Description of the Drawings *(if filed)*
- Detailed Description
- Claim(s)
- Abstract of the Disclosure

3. [x] Drawing(s) *(35 USC 113)* *[Total sheets - 5]*

4. Oath or Declaration *[Total Pages - 3]*
a. [x] Newly unexecuted (original or copy)
b. [] Copy from a prior application (37 CFR 1.63(d))
(for continuation/divisional with Box 17 completed)
[Note Box 5 below]
i. [] DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).

5. [] Incorporation By Reference
(usable if Box 4b is checked)
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

6. [] Microfiche Computer Program *(Appendix)*

7. Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)
a. [] Computer Readable Copy
b. [] Paper Copy (identical to computer copy)
c. [] Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

8. [] Assignment Papers (cover sheet & document(s))
9. [] 37 CFR 3.73(b) Statement [] Power of Attorney
(when there is an assignee)
10. [] English Translation Document *(if applicable)*
11. [] Information Disclosure Statement (IDS)/PTO-1449 [] Copies of IDS Citations
12. [x] Preliminary Amendment
13. [x] Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
14. [] Small Entity Statement(s)
[] Statement filed in prior application, Status still proper and desired
15. [] Certified Copy of Priority Document(s)
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17. If a CONTINUING APPLICATION, *check appropriate box and supply the requisite information:*
[] Continuation [] Divisional [] Continuation-in-part (CIP) of prior application No.

18. CORRESPONDENCE ADDRESS

WENDEROTH, LIND & PONACK, L.L.P.
2033 K Street, N.W.
Suite 800
Washington, D.C. 20006

Phone: (202) 721-8200
Fax: (202) 721-8250

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	:	
Hiroshi KOWAKI	:	
Serial No. NEW	:	**Attn: APPLICATION BRANCH**
Filed April 27, 1999	:	**Docket No.: 113/61561US**
INTEGRATING APPARATUS	:	

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents,
Washington, D.C.

Sir:

Prior to examination of the instant application, please enter and consider the following amendments and remarks as follows:

In The Claims:

Kindly amend claims 6 and 9 as follows:

Claim 6. line 1, change "claims 4 or 5" to --claim 5--.

Claim 9. line 4, change "any one of claims" to --claim--;

line 5, change "1 to 7" to --1--.

Kindly add new claims 10-19 as follows:

-- 10. The integrating apparatus of claim 4, wherein the adding means samples and computes the signal at predetermined sampling time intervals.

11. The integrating apparatus of claim 10, wherein the delaying means delays the signal on a timescale of the predetermined sampling time intervals.

12. A signal processing apparatus comprising:

one or more sensors for detecting a level of physical or chemical value; and

the integrating apparatus according to claim 2, to which the output of the sensor is supplied.

13. A signal processing apparatus comprising:

one or more sensors for detecting a level of physical or chemical value; and

the integrating apparatus according to claim 3, to which the output of the sensor is supplied.

14. A signal processing apparatus comprising:

one or more sensors for detecting a level of physical or chemical value; and

the integrating apparatus according to claim 4, to which the output of the sensor is supplied.

15. A signal processing apparatus comprising:

one or more sensors for detecting a level of physical or chemical value; and

the integrating apparatus according to claim 5, to which the output of the sensor is supplied.

16. A signal processing apparatus comprising:

one or more sensors for detecting a level of physical or chemical value; and

the integrating apparatus according to claim 6, to which the output of the sensor is supplied.

17. A signal processing apparatus comprising:

one or more sensors for detecting a level of physical or chemical value; and

the integrating apparatus according to claim 7, to which the output of the sensor is supplied.

18. A signal processing apparatus comprising:

one or more sensors for detecting a level of physical or chemical value; and

the integrating apparatus according to claim 10, to which the output of the sensor is supplied.

19. A signal processing apparatus comprising:

one or more sensors for detecting a level of physical or chemical value; and

the integrating apparatus according to claim 11, to which the output of the sensor is supplied.--

REMARKS

The present Preliminary Amendment is submitted to delete the multiple dependency of various of the claims and therefore to reduce the required filing fee.

Respectfully submitted,

Hiroshi KOWAKI

By: Jeffrey Nolton
Registration No. 25,408
Attorney for Applicant

JN/pth
Washington, D.C.
Telephone (202) 721-8200

April 27, 1999

SPECIFICATION

TITLE OF THE INVENTION

Integrating Apparatus

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

The present invention relates to an integrating apparatus, and more particularly to an integrating apparatus suited for use with an on-board audio system, for example.

2. DESCRIPTION OF THE RELATED ART

An integrating apparatus is required, for example, by an audio system mounted on an automobile, for measuring the level of noise with a microphone while the automobile is running, and reducing attenuation of audio signals from an audio source such as a radio receiver in response to an increase in the noise level to raise the level of audio output from a loudspeaker. In the prior art, an output corresponding to the noise level from the microphone is applied to an integrating circuit, and the attenuation of audio signals is varied by output from the integrating circuit to determine volume levels. When a small time constant is set for the integrating circuit, the output level of the integrating circuit varies frequently, resulting in drift of the level of audio output from the loudspeaker. In the prior art, therefore, a relatively large time constant is set for the integrating circuit to avoid the drift of the audio

output level.

The prior art has a disadvantage that, with the relatively large time constant set for the integrating circuit, a long time is taken from cessation of a noise level signal from the microphone to lowering of the output level of the integrating circuit. That is, an inconvenience is encountered in which a relatively long time is taken from lowering of the noise level to lowering of the audio output level. When the vehicle stops at a toll gate on an expressway, for example, a long time is taken before lowering of the audio output level. The time taken is 5 to 10 seconds, for example.

Another conventional example is disclosed in Japanese Unexamined Patent Publication JP-A 58-38010 (1983). In this prior art example, a microphone detects external noise, and after a rise in the volume of a loudspeaker, the external noise is masked by the speaker sound. This encumbers detection by the microphone of the external noise actually occurring, thereby to lower the volume of the loudspeaker. This prior art discloses a construction to remedy such a phenomenon. In this prior art, an integrating circuit is used to avoid lowering of the volume due to the masking following a rise in the volume as noted above. This prior art example fails to address the question of reducing the time taken from cessation of a noise level detected by the microphone to lowering of audio signals from the loudspeaker.

SUMMARY OF THE INVENTION

An object of the present invention is to provide an integrating apparatus for preventing frequent variations in integrated output despite variations in input signals, to avoid a drift, and moreover for quickly reducing the integrated output upon cessation of the input signals, thereby to shorten a convergence time of results of integration.

Another object of the invention is to provide an audio system particularly suited for on-board use, which is effective to avoid frequent variations in audio output level in response to noise levels, to avoid a drift, and moreover to reduce the audio output level upon cessation of the noise levels, thereby to shorten a convergence time.

The present invention provides an integrating apparatus comprising:

a plurality of integrating circuits for integrating an input signal and then outputting the integrated input signal; and

selecting means for selectively deriving an output having a lowest level from among outputs of the plurality of integrating circuits;

wherein the plurality of integrating circuits have different fall time constants.

In the invention it is preferable that the integrating

circuits are controlled so that the smaller the fall time constant, the higher an average value of the output levels is.

The invention provides an integrating apparatus comprising:

a plurality of integrating circuits for sharing input signals, having different fall time constants; and

selectively outputting means for selectively deriving an output having a lowest level from among outputs of the respective integrating circuits.

In the invention it is preferable that the number of the plurality of integrating circuits is two.

According to the invention, the two integrating circuits have different fall time constants, and share input signals. The selectively outputting means selectively derives an output having the lowest level from among outputs of these integrating circuits. Consequently, upon cessation of the input signals, the output from the selectively outputting means is reduced quickly to shorten a convergence time for results of integration. While the input signals of varied levels are applied, the output of the integrating circuit having the smaller fall time constant is sent out. Thus, the level of output from the selectively outputting means never varies frequently, thereby preventing a drift occurring with the output of the selectively outputting means.

Gains in a steady state of the plurality of integrating

circuits, namely amplification factors of first amplifying means, are set so that the smaller the fall time constant, the higher the amplification factor is, thus the higher the integrated output level is. That is, in the steady state where the common input signals of fixed level are applied to the plurality of integrating circuits, and a time sufficiently longer than each rise time constant has elapsed, the output levels of the integrating circuits are such that the output level of the integrating circuit having the smaller fall time constant has a larger gain or smaller attenuation factor than the output level of the integrating circuit having the larger fall time constant. The number of the plurality of integrating circuits may be three or more.

According to the invention, the output level of the selectively outputting means is prevented from varying frequently regardless of variations of the input signals. This is effective to avoid a drift of output from the selectively outputting means and moreover to increase the fall convergence rate.

In the invention it is preferable that the integrating apparatus comprises first amplifying means for amplifying the input signals inputted to the plurality of integrating circuits, and the first amplifying means has amplification factors corresponding to the fall time constants of the integrating circuits to which the input signals are inputted, the amplification factor being larger, the smaller the fall time

constant.

In the invention it is preferable that each of the plurality of integrating circuits comprises:

adding means for adding an input signal and a feedback signal and then outputting the added signal;

delaying means for delaying the output of the adding means and then producing the delayed output; and

second amplifying means for amplifying the output of the delaying means and then producing the amplified output;

wherein the output of the second amplifying means is inputted to the adding means as the feedback signal, and the output of the adding means is produced as the output of the integrating circuit.

In the invention it is preferable that the second amplifying means has a gain of less than one.

In the invention it is preferable that the adding means samples and computes the signal at predetermined sampling time intervals.

In the invention it is preferable that the delaying means delays the signal on a timescale of the predetermined sampling time intervals.

In the invention it is preferable that each integrating circuit is arranged so as to sample and compute the input signal at predetermined sampling intervals of time, and the circuit comprises:

first amplifying means for amplifying the input signals;

adding means having two input terminals, for adding levels of signals applied to the input terminals, an output of the first amplifying means being applied to one of the input terminals;

delaying means for producing an output of the adding means after lapse of one or more the sampling intervals of time; and

second amplifying means for amplifying an output of the delaying means to apply as a positive feedback to the other input terminal of the adding means;

wherein a gain of the second amplifying means is to be less than one.

According to the invention, each integrating circuit converts, for example, analog input signals into digital values at predetermined sampling intervals of time. Digital input signals obtained by thus sampling are amplified by the first amplifying means and applied to the adding means. The output of the adding means is delayed by one or more sampling intervals of time, thereafter, amplified by the second amplifying means, and then applied as a positive feedback to the adding means. The gain of the second amplifying means is set less than one to prevent oscillation. The components such as the first and second amplifying means, adding means and delaying means are operable synchronously with the sampling intervals of time. By varying the gain of the second amplifying means, the fall time constants of the integrating apparatus are determined.

According to the invention, the integrating circuits are achieved by computations performed by microcomputers or the like. Each fall time constant may readily be determined as an only value by varying the gain of the second amplifying means.

The invention further provides an audio system comprising:

an audio source for outputting an audio signal;

attenuating means for attenuating the audio signal in response to a level of a control signal; and

noise detecting means for outputting a noise signal in response to a noise level;

the audio system comprising the integrating apparatus,

wherein the integrating circuits of the integrating apparatus receive the noise signal as an input signal, and the attenuating means receives the output signal of the selecting means as a control signal.

The invention provides an audio system comprising:

an audio source;

attenuating means for attenuating audio signals from the audio source, an attenuation of the attenuating means being variable with a level of a control signal;

a microphone for detecting noise;

a pair of integrating circuits for sharing an output of the microphone, having different fall time constants; and

selectively outputting means for selectively deriving an

output having a lowest level from among outputs of the respective integrating circuits, and applying the output having the lowest level as the control signal to the attenuating means.

According to the invention, audio signals from an audio source such as a radio receiver or means for playing tapes or other recording media are turned into audible sound via the attenuating means through, for example, a loudspeaker. The attenuating means makes an attenuation possible, which corresponds to the level of the control signal inputted thereto. The microphone derives out an output having a level corresponding to the noise level, and then the output is shared between the pair of integrating circuits. An output having a lower level selected from among outputs of the respective integrating circuits are sent from the selectively outputting means and supplied to the attenuating means as the control signal. Thus, when the noise level is high, the outputs of the integrating circuits increase, and the attenuation by the attenuating means is reduced thereby to increase the volume from the audio source at being turned into audible sound through the loudspeaker. Upon cessation or reduction of the noise, the output from the selectively outputting means reduces quickly to shorten its convergence time. Accordingly, the level of the control signal applied to the attenuating means lowers quickly to increase attenuation, thereby lowering the level, at being turned into audible sound, of the audio signals supplied from

the audio source.

The microphone may be disposed adjacent the loudspeaker, or far from the loudspeaker not to be susceptible to influences of the sound from the loudspeaker.

In another embodiment of the invention, the attenuating means may be replaced with amplifying means for varying an amplifying gain so as to vary the audio signals from the audio source in response to the level of the control signal. Where the attenuating means is used, the attenuating means is operable to reduce attenuation when the level of the control signal is raised, that is when the noise level increases. Where the amplifying means is used in place of the attenuating means, the amplifying means is operable to increase the amplifying gain when the level of the control signal is raised, that is when the noise level increases.

According to the invention, in an on-board audio system, for example, an audio output level rises in a state of a high noise level while a vehicle is running. The audio output level never varies frequently, thus its variation of the audio output level is smooth, whereby it is possible to avoid a drift of the audio output level. Moreover, when the vehicle stops at a toll gate on an expressway, for example, the audio output level is lowered immediately to make the rider comfortable.

The invention further provides a signal processing apparatus comprising:

one or more sensors for detecting a level of physical or chemical value; and

one of the integrating apparatuses to which the output of the sensor is supplied.

According to the invention, one or more sensors are provided, and the sensor detects the level of the physical value or detects the level of the chemical value. In the construction having a single sensor, the sensor is shared between the plurality of integrating circuits. In the construction having a plurality of sensors, the outputs of the respective sensors are individually supplied to the plurality of integrating circuits. The outputs of the sensors may be directly supplied to each of the integrating circuits. Also, in another embodiment, a circuit such as a filter 38 (see Fig. 5) may be provided between one or more sensors and one or more integrating circuits, as described below. The above-mentioned microphone for detecting the noise may be employed as the sensor. In the construction having a plurality of sensors serving as the microphones, for example, one sensor is mounted in the vicinity of the ceiling of a vehicle such as automobile to detect noise, the other sensor is mounted on the floor of the vehicle to detect noise. The outputs of the respective sensors are supplied to each of two integrating circuits. An output of a lowest level is selected from among the outputs of the respective integrating circuits and outputted from the selectively outputting means.

The sensor mounted on the ceiling detects noise in the interior of the vehicle. The sensor mounted on the floor detects rumbles of an internal-combustion engine for driving the vehicle and of the body of the vehicle. Thus, on the basis of the outputs of the sensors having a different object to be detected, it is possible to avoid a drift in the outputs from the selectively outputting means, and moreover to increase the fall convergence rate.

In another embodiment of the invention, the sensor may have a construction for detecting a moving body, which is employed in radar or the like, furthermore the sensor may be a pressure sensor for detecting an inhalation air pressure of air for combustion in an internal-combustion engine, a sensor for detecting a current to be applied to a load, a sensor for detecting power consumption of a load, a sensor for detecting the level of a physical value other than the above values, and a sensor for detecting the level of a chemical value.

BRIEF DESCRIPTION OF THE DRAWINGS

Other and further objects, features, and advantages of the invention will be more explicit from the following detailed description taken with reference to the drawings wherein:

Fig. 1 is a block diagram showing an electrical construction of an integrating apparatus 1 according to an embodiment of the present invention;

Fig. 2 is a block diagram showing an electrical construction of an on-board audio system 2 having the integrating apparatus 1 shown in Fig. 1;

Figs. 3A and 3B are waveform diagrams showing results of experiment conducted by the present inventor;

Fig. 4 is a block diagram showing an electrical construction according to another embodiment of the invention;

Fig. 5 is a block diagram showing an electrical construction according to another embodiment of the invention; and

Fig. 6 is a block diagram showing still another embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Now referring to the drawings, preferred embodiments of the invention are described below.

Fig. 1 is a block diagram showing an electrical construction of an integrating apparatus 1 according to an embodiment of the present invention. Fig. 2 is a block diagram showing an electrical construction of an on-board audio system 2 having the integrating apparatus 1 shown in Fig. 1. The on-board audio system 2 is mounted on a vehicle such as an automobile. An audio source 3 is a radio receiver or reproducing device, for example, for sending out audio signals. The reproducing device plays magnetic tapes, compact disks or

the like to output audio signals. An output of the audio source 3 is applied to attenuating means 4 known as an electronic volume. An audio output of the attenuating means 4 is amplified by an amplifying circuit 5, and turned into audible sound by a loudspeaker 6 disposed in a vehicle's interior.

The interior of the vehicle is further provided with a microphone 7 for sending out an output having a level corresponding to a noise level so as to supply the output to an amplifying circuit 8. An output of the amplifying circuit 8 is applied to the integrating apparatus 1 of the invention through a line 9. An integrated output of the integrating apparatus 1 is applied as a control signal through a line 10 to an attenuation determining circuit 32. The attenuation determining circuit 32 sends out a control signal for determining an attenuation. An output of the attenuation determining circuit 32 is applied to the attenuating means 4 through a line 33.

A signal indicating the noise level is applied from the line 9 to an absolute value circuit 11 shown in Fig. 1. The absolute value circuit 11 computes and outputs an absolute value of the signal received through the line 9. The absolute value circuit 11 may be in the form of a full-wave rectifier circuit, for example. An output of the absolute value circuit 11 is applied through a line 12 to a first integrating circuit 13 and a second integrating circuit 14. These first and second

integrating circuits 13 and 14 are similar in construction. Like components will be identified with like reference numerals, with letters a and b affixed thereto, and only the reference numeral will be used in referring to a pair of such components. The signal on the line 12 is applied to first amplifying means 15 of each integrating circuit. Adding means 16 has two input terminals. The adding means 16 adds levels of signals applied to the two input terminals 17 and 18, and sends out the result to a line 19. One of the input terminals 17 receives the output of the first amplifying means 15.

The signal of the adding means 16 sent out to the line 19 is applied to delaying means 21 where the signal is delayed, then the signal is applied to second amplifying means 22. An output of the second amplifying means 22 is applied to the other input terminal 18 of adding means 16 as a positive feedback.

Each signal sent out from the adding means 16 to the line 19 is applied to selectively outputting means 23. The selectively outputting means 23 derives an output having the lower signal level among the signals on the lines 19a and 19b, and supplies the output to the line 10 as a control signal.

The components 15-22 constituting the integrating circuits 13 and 14 may, for example, be accomplished by performing computations by processing circuits in the form of microcomputers or the like. In such a construction, analog signals sent out from the absolute value circuit 11 to the line

12 are applied to the integrating circuits 13 and 14 after being converted to digital values at predetermined sampling intervals of time by an analog-to-digital converter. The delaying means 21 delays the signals by one or more sampling intervals, and in this embodiment, for example, delays the signals on the line 19 by one sampling interval, then the delayed signals are applied to the second amplifying means 22.

The second amplifying means 22a in the first integrating circuit 13 may have a gain g22a set to a value less than one, e.g. g22a = 0.9999. The first amplifying means 15a may have a gain g15a set such that a sum of signal levels at the input terminals 17a and 18a standardized by a level of input signal on the line 12 does not exceed 1, e.g. g15a = 0.002 in this embodiment. Similarly, the second amplifying means 22b in the second integrating circuit 14 may have a gain g22b , for example, set at g22b = 0.9990. Further, the first amplifying means 15b has a gain g15b set such that a sum of signal levels at the input terminals 17b and 18b standardized by the input signal on the line 12 does not exceed 1, e.g. g15b = 0.03. The audio signals on the line 12 may be digitized to 16 bits, for example. Sampling frequency Fs may be 44100Hz, for example.

The first integrating circuit 13 has a time constant T expressed by the following equation (1):

$$T = n/Fs \qquad \ldots (1)$$

where n is the number of circulations made by a signal, under

the condition of the sampling frequency Fs, through a closed loop formed by the adding means 16a, delaying means 21a and second amplifying means 22a, until the signal becomes -60dB, for example. This time constant T is set to a value in the range of 5 to 10 seconds, for example. This applies also to the other integrating circuit 14.

In the first and second integrating circuits 13 and 14;

$$g22a > g22b \quad \ldots (2)$$

The gains g22a and g22b of the second amplifying means 22a and 22b are in the following relationship:

$$g22a > g22b \quad \ldots (3)$$

Thus, the time constant of the first integrating circuit 13 is large, and the time constant of the second integrating circuit 14 is less than the time constant of the first integrating circuit 13.

Figs. 3A and 3B are waveform diagrams showing results of experiment conducted by the present inventor. A waveform shown by reference numeral 25 in Fig. 3A represents a signal showing a noise level applied from the microphone 7 to the line 9 through the amplifying circuit 8. Consequently, the first integrating circuit 13 sends out signals of waveforms shown by reference numerals 26 and 27 to the line 19a. The second integrating circuit 14 has a smaller time constant than the first integrating circuit 13, and sends out to the line 19b an integrated output varying frequently in response to the noise level, as shown by

reference numerals 28, 29, 30 and 31. As a result, the selectively outputting means 23 selectively derives an output having a lowest level from among these signals 26-29. Fig. 3B shows a waveform of signal sent out from the selectively outputting means 23 to the line 10. When the noise level is high, the output of integrating circuit 13 having the larger time constant is sent out as shown by reference numeral 26 in Fig. 3B.

Upon cessation of the noise level as when the vehicle stops, the output of integrating circuit 14 having the smaller time constant is sent out as shown by reference numerals 29, 30 and 31. The attenuating means 4 described with reference to Fig. 2 makes the attenuation possible, by the attenuation determining circuit 32, which corresponds to the level of the control signal with the waveform shown in Fig. 3B sent out to the line 10. The attenuation is the smaller, the higher is the control signal level. Thus, the higher the noise level, the higher level of audio output is made from the loudspeaker 6. When the vehicle stops to reach the noise level to zero or a value close to zero, the attenuation by the attenuating means 4 increases sharply as shown in the waveform 29, to reduce the audio level of the loudspeaker 6.

Fig. 4 is a block diagram showing an electrical construction according to another embodiment of the invention. In the embodiment shown in Fig. 1 as described above, the signals

are digitally processed and computed by a microcomputer or the like. In the embodiment of Fig. 4, however, the integrating circuits 13 and 14 are realized by analog circuits, and the absolute value circuit 11 and the selectively outputting means 23 are also realized by analog circuits. In the integrating circuit 13 of Fig. 4, a capacitor C1 for integration is connected between a inverse input terminal and output terminal of a computing amplifier 36, and the inverse input terminal is connected to the line 12 through which the output of the absolute value circuit 11 is sent out via a resistor R2. The non-inverse input terminal of the computing amplifier 36 is connected to a resistor R3 and grounded. A time constant of the integrating circuit 13 is determined by a capacitance of the capacitor C1 and a resistance of the resistor R2. Like the integrating circuit 13, the integrating circuit 14 also includes a computing amplifier 37, a capacitor C2, and resistors R4 and R5, and has a time constant which is determined by a capacitance of the capacitor C2 and a resistance of the resistor R4. Other construction and operation are the same as the above-mentioned embodiment. The invention includes not only the construction of Fig. 1, as described above, for digital-processing the signal from the line 9, but also the construction of Fig. 4 for analog-processing.

Fig. 5 is a block diagram showing an electrical construction according to another embodiment of the invention.

This embodiment is similar to the above-mentioned embodiment, and the corresponding parts between the embodiments are denoted by the same reference numerals. Especially in this embodiment, the signal from the line 12 is supplied to the integrating circuit 13 via a filter 38. The filter 38 may be a low-pass filter, a band-pass filter, and a high-pass filter. The filter 38 has a time constant which is different from those of the integrating circuits 13 and 14, and serves for eliminating noise in order to prevent the integrating circuit 13 from failing to operate properly due to the noise.

Fig. 6 is a block diagram showing still another embodiment of the invention. This embodiment is similar to the above-mentioned embodiment, and the corresponding parts between the embodiments are denoted by the same reference numerals. A plurality of (in the embodiment, for example, two) sensors 39 and 40 detect a level of a physical value or detects a level of a chemical value. Outputs of the respective sensors 39 and 40 are supplied to absolute value circuits 41 and 42, respectively. The absolute circuits 41 and 42 have the same construction as those of the above-mentioned absolute value circuit 11. The sensor 39 is provided with the absolute value circuit 41 and the integrating circuit 13, and the sensor 40 is provided with the absolute value circuit 42 and the integrating circuit 14. Outputs of the integrating circuits 13 and 14 are supplied to the selectively outputting means 23,

an output which has the lowest level among levels of integrating outputs is sent out to the line 10. The invention can be thus embodied in relation to various applications.

The integrating apparatus according to the invention is not limited to incorporation into an on-board audio system. This apparatus may find wide application including detection of a flow rate of a fluid such as water.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description and all changes which come within the meaning and the range of equivalency of the claims are therefore intended to be embraced therein.

WHAT IS CLAIMED IS:

1. An integrating apparatus comprising:

a plurality of integrating circuits for integrating an input signal and then outputting the integrated input signal; and

selecting means for selectively deriving an output having a lowest level from among outputs of the plurality of integrating circuits;

wherein the plurality of integrating circuits have different fall time constants.

2. The integrating apparatus of claim 1, wherein the integrating circuits are controlled so that the smaller the fall time constant, the higher an average value of the output levels is.

3. The integrating apparatus of claim 1, comprising first amplifying means for amplifying the input signals inputted to the plurality of integrating circuits,

wherein the first amplifying means has amplification factors corresponding to the fall time constants of the integrating circuits to which the input signals are inputted, the amplification factor being larger, the smaller the fall time constant.

4. The integrating apparatus of claim 3, wherein each of the plurality of integrating circuits comprises:

adding means for adding an input signal and a feedback

signal and then outputting the added signal;

delaying means for delaying the output of the adding means and then producing the delayed output; and

second amplifying means for amplifying the output of the delaying means and then producing the amplified output,

wherein the output of the second amplifying means is inputted to the adding means as the feedback signal, and the output of the adding means is produced as the output of the integrating circuit.

5. The integrating apparatus of claim 4, wherein the second amplifying means has a gain of less than one.

6. The integrating apparatus of claims 4 or 5, wherein the adding means samples and computes the signal at predetermined sampling time intervals.

7. The integrating apparatus of claim 6, wherein the delaying means delays the signal on a timescale of the predetermined sampling time intervals.

8. An audio system comprising:

an audio source for outputting an audio signal;

attenuating means for attenuating the audio signal in response to a level of a control signal; and

noise detecting means for outputting a noise signal in response to a noise level;

the audio system comprising the integrating apparatus,

wherein the integrating circuits of the integrating

apparatus receive the noise signal as an input signal, and the attenuating means receives the output signal of the selecting means as a control signal.

9. A signal processing apparatus comprising:

one or more sensors for detecting a level of physical or chemical value; and

the integrating apparatus according to any one of claims 1 to 7, to which the output of the sensor is supplied.

ABSTRACT OF THE DISCLOSURE

An object of the invention is to lower the levels of audio outputs of an on-board audio system immediately upon the stop of a vehicle. Audio signals from an audio source are amplified through attenuating means by amplifying means to drive a loudspeaker. An output of a microphone for detecting noise is inputted to each of two integrating circuits. These integrating circuits have different fall time constants. Outputs of the integrating circuits are applied to selectively outputting means, which selectively derives an output having a lower level and then supplies the output as a control signal to the attenuating means. When the level of noise is high while the vehicle is running, the control signal has a high level and the attenuating means reduces an attenuation. Thus, the output of the audio source may be heard without a drift of the audio signal level. When the vehicle stops at a toll gate on an expressway, for example, the control signal level is lowered immediately, whereby the attenuation of the attenuating means is increased with the result that the convergence rate of a fall of the audio output is increased.

FIG. 1

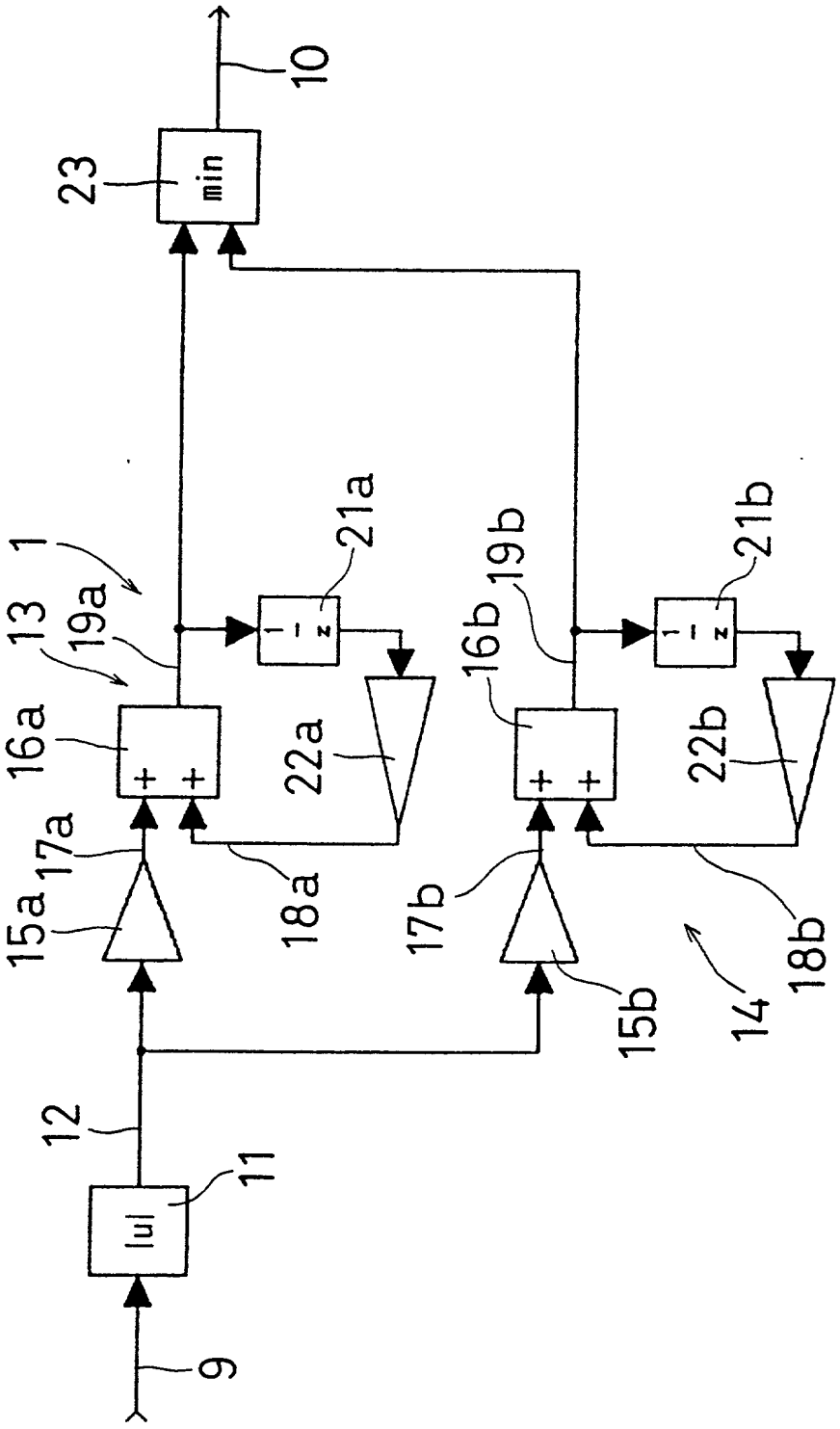


FIG. 2

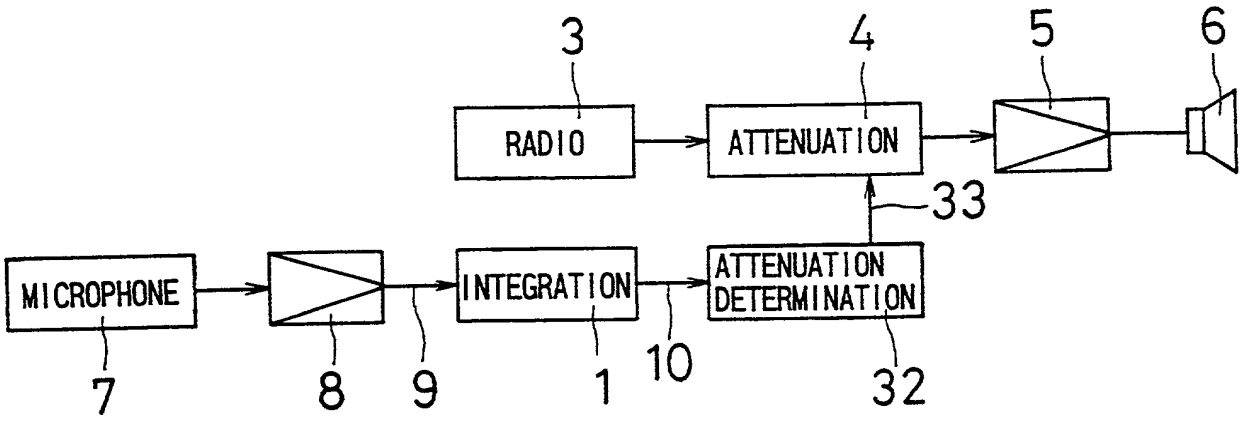

3
4
5
6
RADIO
ATTENUATION
33
MICROPHONE
INTEGRATION
ATTENUATION DETERMINATION
7
8
9
1
10
32

FIG. 3A

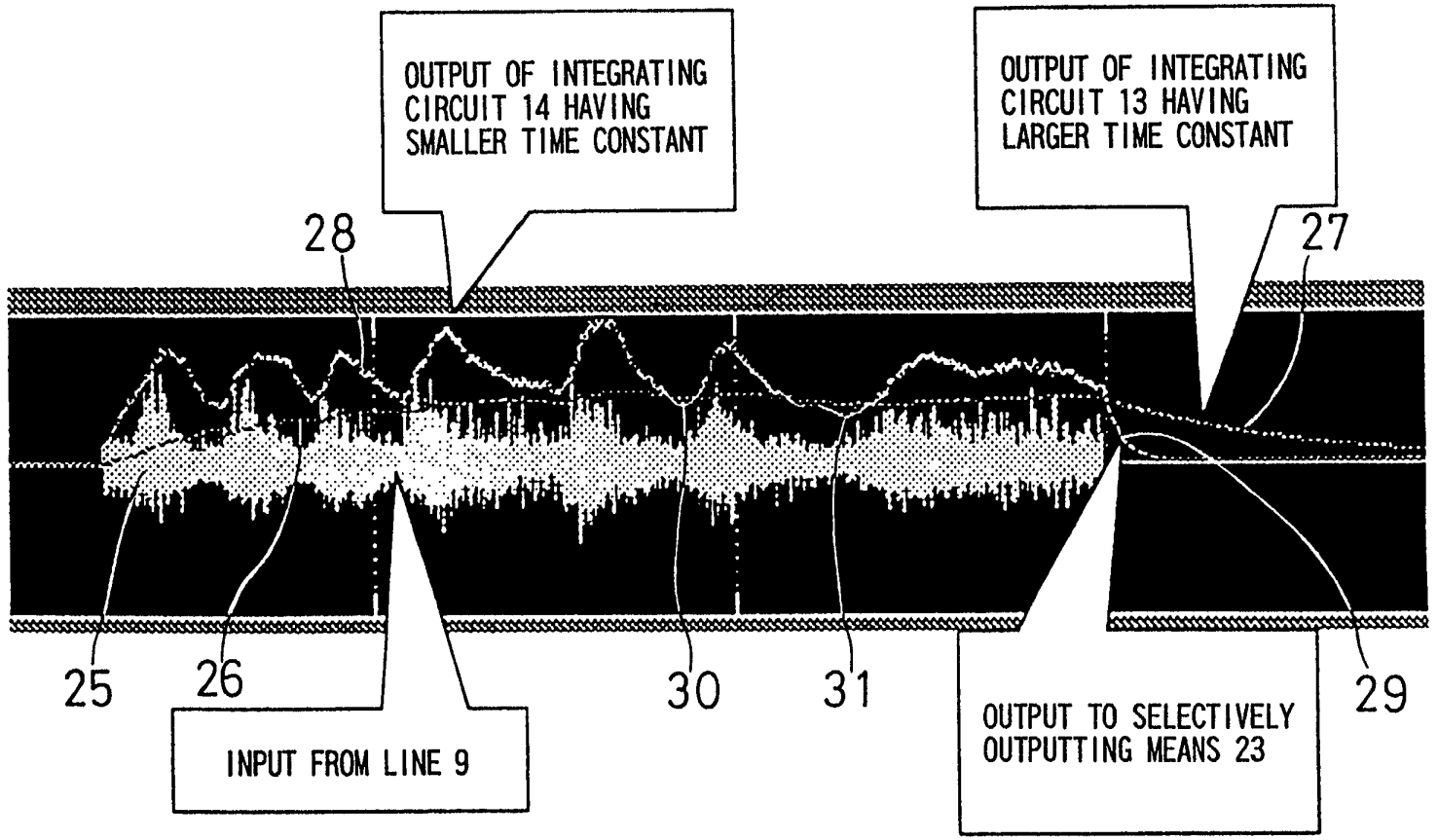

OUTPUT OF INTEGRATING CIRCUIT 14 HAVING SMALLER TIME CONSTANT
OUTPUT OF INTEGRATING CIRCUIT 13 HAVING LARGER TIME CONSTANT
28
27
25
26
30
31
29
INPUT FROM LINE 9
OUTPUT TO SELECTIVELY OUTPUTTING MEANS 23

FIG. 3B

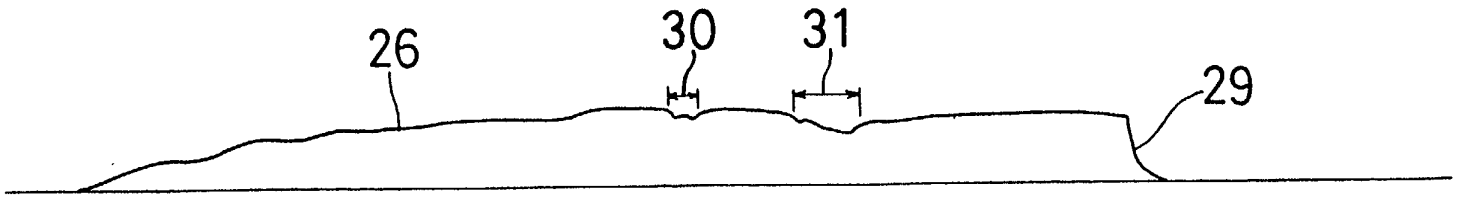

26
30
31
29

FIG. 4

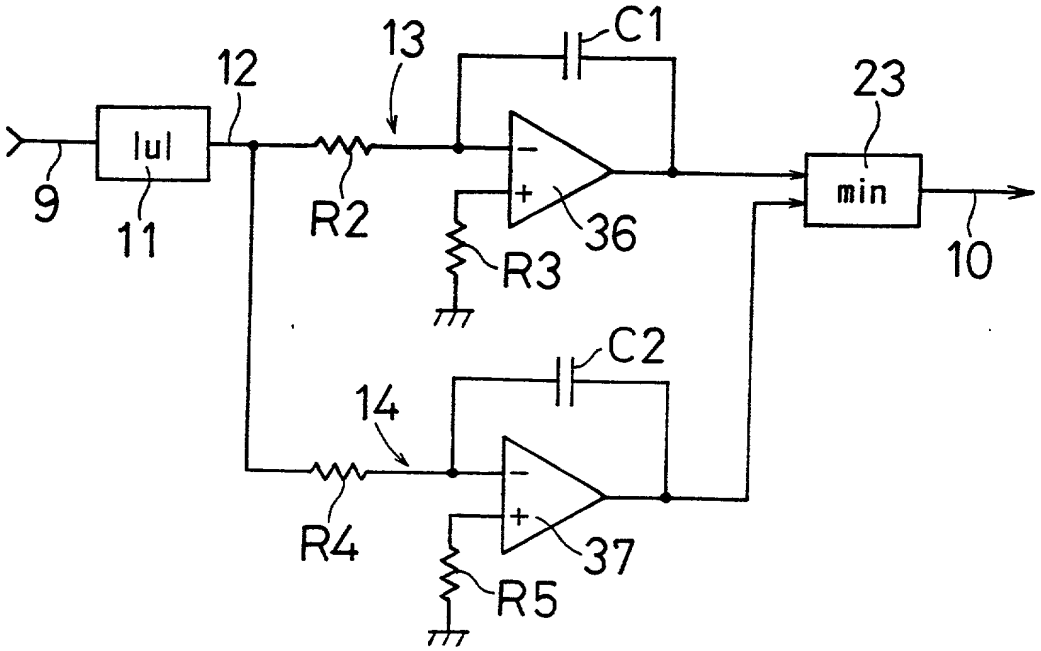

13
C1
12
23
|u|
9
11
R2
36
min
10
R3
C2
14
R4
37
R5

FIG. 5

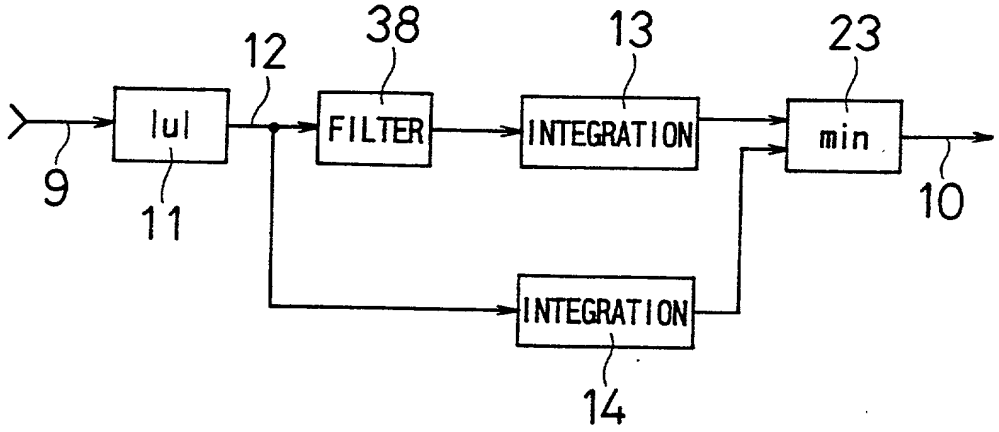
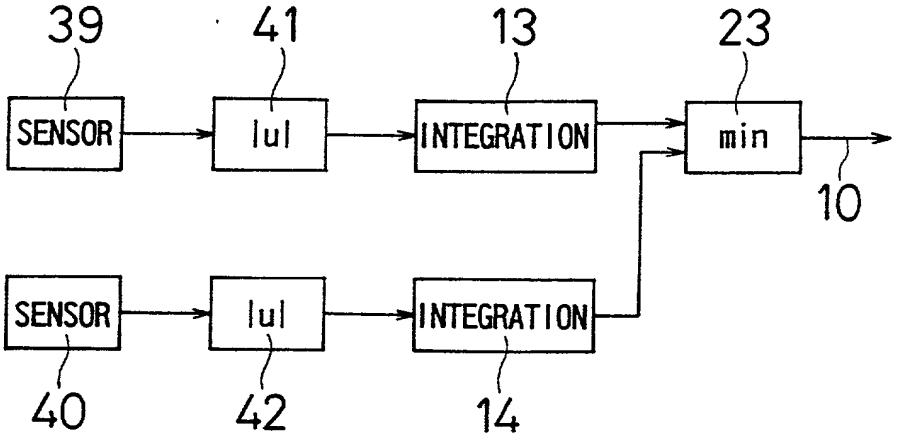

38
13
12
23
|u|
FILTER
INTEGRATION
min
9
11
10
INTEGRATION
14

FIG. 6


39
41
13
23
SENSOR
lul
INTEGRATION
min
10
SENSOR
lul
INTEGRATION
40
42
14

DECLARATION AND POWER OF ATTORNEY FOR U.S. PATENT APPLICATION

(x) Original ( ) Supplemental ( ) Substitute ( ) PCT ( ) Design

As a below named inventor, I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that I verily believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Title: INTEGRATING APPARATUS

of which is described and claimed in:
( ) the attached specification, or
(x) the specification in the application Serial No. _____ filed April 27, 1999 ;
and with amendments through _____ (if applicable), or
( ) the specification in International Application No. PCT/_____, filed ___, and as amended on _____ (if applicable).

I hereby state that I have reviewed and understand the content of the above-identified specification, including the claims, as amended by any amendment(s) referred to above.

I acknowledge my duty to disclose to the Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim priority benefits under Title 35, United States Code, §119 (and §172 if this application is for a Design) of any application(s) for patent or inventor's certificate listed below and have also identified below any application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

COUNTRY	APPLICATION NO.	DATE OF FILING	PRIORITY CLAIMED
Japan	10-117286	April 27, 1998	Yes

I hereby claim the benefit under Title 35, United States Code §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose information material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

APPLICATION SERIAL NO.	U.S. FILING DATE	STATUS: PATENTED, PENDING, ABANDONED

And I hereby appoint Michael R. Davis, Reg. No. 25,134; Matthew M. Jacob, Reg. No. 25,154; Jeffrey Nolton, Reg. No. 25,408; Warren M. Cheek, Jr., Reg. No. 33,367; Nils E. Pedersen, Reg. No. 33,145; and, Charles R. Watts, Reg. No. 33,142, who together constitute the firm of WENDEROTH, LIND & PONACK, L.L.P., jointly and severally, attorneys to prosecute this application and to transact all business in the U.S. Patent and Trademark Office connected therewith.

I hereby authorize the U.S. attorneys named herein to accept and follow instructions from IIS SAIKYO PATENT OFFICE as to any action to be taken in the U.S. Patent and Trademark Office regarding this application without direct communication between the U.S. attorneys and myself. In the event of a change in the persons from whom instructions may be taken, the U.S. attorneys named herein will be so notified by me.

Send Correspondence to

WENDEROTH, LIND & PONACK, L.L.P.
Suite 800
2033 K Street, N.W.
Washington, D.C. 20006

Direct Telephone Calls to:

WENDEROTH, LIND & PONACK, L.L.P.
Area Code (202) 721-8200

Direct Facsimile Messages to:
Area Code (202) 721-8250

Full Name of First Inventor	FAMILY NAME KOWAKI	FIRST GIVEN NAME Hiroshi	SECOND GIVEN NAME	
Residence & Citizenship	CITY Hyogo	STATE OR COUNTRY Japan	COUNTRY OF CITIZENSHIP Japan	
Post Office Address	ADDRESS 361-1-111, Nishioka, Uozumi-cho, Akashi-shi, Hyogo, Japan	CITY	STATE OR COUNTRY	ZIP CODE
Full Name of Second Inventor	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME	
Residence & Citizenship	CITY	STATE OR COUNTRY	COUNTRY OF CITIZENSHIP	
Post Office Address	ADDRESS	CITY	STATE OR COUNTRY	ZIP CODE
Full Name of Third Inventor	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME	
Residence & Citizenship	CITY	STATE OR COUNTRY	COUNTRY OF CITIZENSHIP	
Post Office Address	ADDRESS	CITY	STATE OR COUNTRY	ZIP CODE
Full Name of Fourth Inventor	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME	
Residence & Citizenship	CITY	STATE OR COUNTRY	COUNTRY OF CITIZENSHIP	
Post Office Address	ADDRESS	CITY	STATE OR COUNTRY	ZIP CODE

Full Name of Fifth Inventor	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME	
Residence & Citizenship	CITY	STATE OR COUNTRY	COUNTRY OF CITIZENSHIP	
Post Office Address	ADDRESS	CITY	STATE OR COUNTRY	ZIP CODE
Full Name of Sixth Inventor	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME	
Residence & Citizenship	CITY	STATE OR COUNTRY	COUNTRY OF CITIZENSHIP	
Post Office Address	ADDRESS	CITY	STATE OR COUNTRY	ZIP CODE
Full Name of Seventh Inventor	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME	
Residence & Citizenship	CITY	STATE OR COUNTRY	COUNTRY OF CITIZENSHIP	
Post Office Address	ADDRESS	CITY	STATE OR COUNTRY	ZIP CODE

I further declare that all statements made herein of my own knowledge are true, and that all statements on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

1st Inventor Hiroshi KOWAKI _____ Date _____

2nd Inventor _____ Date _____

3rd Inventor _____ Date _____

4th Inventor _____ Date _____

5th Inventor _____ Date _____

6th Inventor _____ Date _____

7th Inventor _____ Date _____

The above application may be more particularly identified as follows:

U.S. Application Serial No. _____ Filing Date April 27, 1999

Applicant Reference Number 61561US/TEN-115 Atty Docket No. 113/61561US

Title of Invention INTEGRATING APPARATUS